Thoughts on Radioecological Sensitivity Concept Document, for EMRAS-II Environmental Sensitivity Working Group

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In response to B. Tracy's 2010 September 21 email inviting thoughts from the working group members on "Sensitivity Concept", two main thoughts are: (1) we should broaden the sensitivity definition (and accordingly broaden the modelling exercise) to start from the release rate (to air and to water) and to end at the doses to humans as well as to non-human biota, and (2) we should continue to perform calculations for the modelling exercise, that work will likely help sharpening the definition also. Details about these thoughts with illustrations are given below.

Starting point of the modeling exercise: Although, initially, it was a good idea to start the exercise with the deposition, due to some working group members continue to give suggestions to broaden the concept, we should start the exercise from the source term from an accident, with the following information:

1) How many Bq in total of each radionuclide are released from a real or a hypothetical accident from a nuclear facility or from a nuclear device?
2) To air, water, soil, or sediment?
3) To river, lake or ocean?
4) In what form (gas, liquid, solid, powder, attached to some particulates, information needed for assigning appropriate deposition velocities)?
5) In rainy or dry conditions?
6) Over what duration?

These are the pieces of information that are usually available when an accident happens,

End point of the modeling exercise: Although, initially, it was a good idea to end the exercise at prediction of dose to humans, due to some working group members continue to give suggestions to broaden the concept, we should end the exercise with predictions of doses to humans as well as non-human biota. To illustrate this, we can think about the oil release from BP, and effect of non-human biota was much larger compared to humans. The environmental sensitivity index simply based upon the effect to humans would have not done a justifiable job. Therefore, our end point should be based on how much collective impact there is on humans and non-human biota.

The above two points will force us to consider a variety of scenarios corresponding to a variety of accident situations, which will also help in fine tuning the concept and the definition as well. Most likely, we will not be able to complete and document these exercises before the end of EMRAS-II term, but the remaining work may be rolled-over into a future working group in future EMRAS.

In my opinion, for the remainder of the EMRAS-II term, the working group will likely spend time in the following three tasks:

(1) **Defining environmental sensitivity and creating a sensitivity index:** In my mind, doing this task is somewhat similar to how an index gets assigned after each earth quake. In the last two years, we have tried to establish a method for assigning an environmental sensitivity

index to a possible nuclear accident. However, with our limited knowledge-base, and desire and resources, we have not been able to define a scaling method yet that can be accepted internationally. Therefore, we should not spend too much more time and effort on establishing a more accurate definition and an indexing method. We should take the suggestions from the group members and accordingly make corrections to the already prepared concept document and come up with a simple, practical and understandable definition, and move on.

(2) **Studying environmental sensitivities**: This working group can run (extend and run) various scenarios from different "release amounts to air and to water" in various ecosystems and predict "doses to humans as well as to non-human biota" in various environments.

Effect = dose received by each organism / bench mark dose for that organism

Summation of these Effects on humans and on non-human biota will be the final effect.

At the end we can publish a report which will show the environmental sensitivities of various environments based upon the scenarios considered.

(3) **Recommending methods to estimate environmental sensitivity in case of an accident:** This may include:

(a) What steps should be taken to predict the sensitivity of a particular environment, for a given release of various types?
(b) Which pathways should be considered for various types of accidents?
(c) How to estimate environmental conditions, what kinds of models should be used (we can compile a list of recommended models)?
(d) What kind of parameter values should be used (a list of recommended default parameter values may mostly come from TRS-472 for human and an upcoming TRS for non-human biota)?
(e) How to run the models and predicting doses to human and non-human biota?
(f) How to run simulations with and without applying shelter, counter measures and food bans (if the sheltering, counter measures and food bans can bring positive results, then suggest applying them)?

This way this working group can increase awareness regarding what to do if a nuclear accident happens.

In my **opinion**, we should quickly finalize the definition (Task 1 above) and then spend most of the next year on Task 2 with a variety of modelling exercises (starting from the release rates and predicting doses to human and non-human biota), which will also help with Tasks 1 and 3.